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Massive subcutaneous emphysema following routine endotracheal intubation

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Abstract
Upper aerodigestive tract injury after endotracheal intubation is a rare but serious complication. The case of a 57-year-old female, who developed extensive neck and thoracic subcutaneous emphysema and pneumomediastinum following a knee arthroscopy under general anaesthesia, is presented. Possible mechanisms of injury and management options are discussed.

Key words: Subcutaneous Emphysema; Mediastinal Emphysema; Intubation, Intratracheal

Introduction

Subcutaneous emphysema in the head and neck region is caused by the inadvertent introduction of air into the soft tissues: most commonly due to trauma of the upper aerodigestive tract.[1] In the absence of a penetrating injury or surgery, it is a rare finding in the head and neck. It can lead to compression of adjacent vital structures, such as the great vessels and the trachea. Mediastinitis and sepsis can also result and mortality has been reported as high as 10–15 per cent.[2]

Case report

A 57-year-old female underwent a diagnostic right knee arthroscopy as a day case under general anaesthesia. Induction was with sevoflurane. Intubation was under direct vision with a size 8, cuffed orotracheal tube. The patient was extubated without laryngospasm or other airway obstruction. The total anaesthetic time was 45 minutes and was performed entirely by a consultant anaesthetist. The patient was discharged home on the same day. Later that evening she noticed generalized swelling of her neck and complained of a sore throat. Over the following days the neck swelling progressed and on the fourth post-operative day, she attended the Accident and Emergency department and was immediately referred to the Otolaryngology service.

On presentation she complained of a mild sore throat with neck pain, but was in no obvious distress. Her vital signs were stable and she was apyrexial. There was extensive bilateral swelling of her neck, extending from the inferior border of the body of the mandible to the level of the eighth costal cartilage. Gross crepitus was felt on palpation of her neck and upper anterior thorax. A full otolaryngological examination, including flexible nasolaryngoscopy was performed. There was no internal airway compression and no evidence of mucosal tears in the pharynx or larynx.

A routine white cell count was normal. A soft tissue radiograph of her neck showed extensive subcutaneous emphysema in the soft tissues of her neck. A chest radiograph revealed a pneumomediastinum, (Figure 1). An axial computed tomography (CT) of the neck and thorax showed a large amount of air surrounding the trachea and great vessels (Figures 2 and 3). A gastrografin swallow was normal. Rigid endoscopy was not performed.

The patient was closely monitored with two hourly observations, kept nil orally and commenced on nasogastric feeding. The nasogastric tube was passed under fluoroscopic guidance. Broad spectrum intravenous antibiotics (benzylpenicillin 1.2 gm q.d.s. and metronidazole 500 mg t.d.s.) were administered. Chest radiographs were performed daily to monitor resolution of the pneumomediastinum. After five days of conservative treatment, the subcutaneous emphysema started to resolve. An oral diet

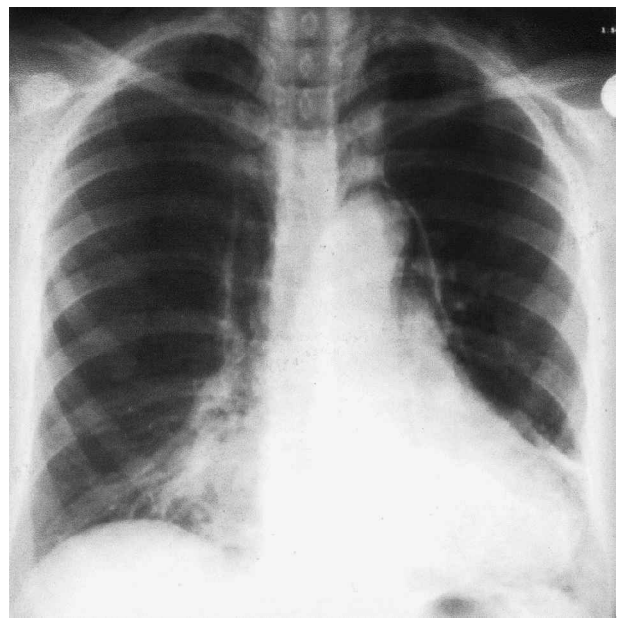

Fig. 1
Chest radiograph showing a pneumomediastinum.

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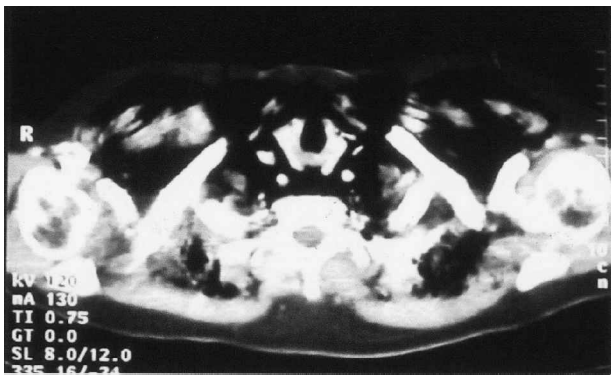

FIG. 2

Axial computed tomogram of the neck showing extensive air surrounding the trachea, carotid arteries and internal jugular veins.

was re-introduced on day seven. This was tolerated well and the patient was discharged home on day nine. On review in the clinic one week later, the emphysema had fully resolved and at her three-monthly review, the patient remains well.

- **Upper aerodigestive tract injury after endotracheal intubation is a rare but serious complication**
- **Possible mechanisms of injury and management options are discussed**

Discussion

On review of the literature the majority of cases of cervical subcutaneous emphysema are secondary to traumatic neck injuries or tracheobronchial surgery.[1,3] There are few reports of aerodigestive tract injury secondary to endotracheal intubation.[4–6] Two mechanisms for air leakage into the soft tissues of the neck following endotracheal intubation have been postulated. Firstly, a tear in the tracheal mucosa may occur on either passage of the endotracheal tube or overinflation of the cuff.[7] Secondly, there may be a congenital dehiscence in the mucosa, which can rupture if ventilatory pressures are high.[4] Examples of congenital airway dehiscences include bullae, clefts, and laryngocoeles.

Subcutaneous emphysema involving the head and neck can result in complications by two main mechanisms: pressure on adjacent structures and infection. Pressure from expanding air in the neck, has the potential to compress the trachea and major blood vessels. Acute airway obstruction may result requiring endotracheal re-intubation or tracheostomy if the airway is distorted. In the chest, venous compression from a pneumomediastinum can result in venous congestion, a decrease in cardiac output and, if severe, death. The passage of oropharyngeal secretions through a traumatic perforation in the upper aerodigestive tract can contaminate the surrounding tissues and result in cervical and mediastinal infection and abscess formation.

Subcutaneous emphysema and neck crepitus are diagnostic of an upper aerodigestive tract injury.[1] Additional symptoms may include neck pain, odynophagia and dyspnoea. A full otolaryngological examination should be performed, including a flexible nasolaryngoscopy. A chest radiograph is performed to identify pneumomediastinum or a pneumothorax. Computed tomography of the thorax is helpful in establishing the extent of the

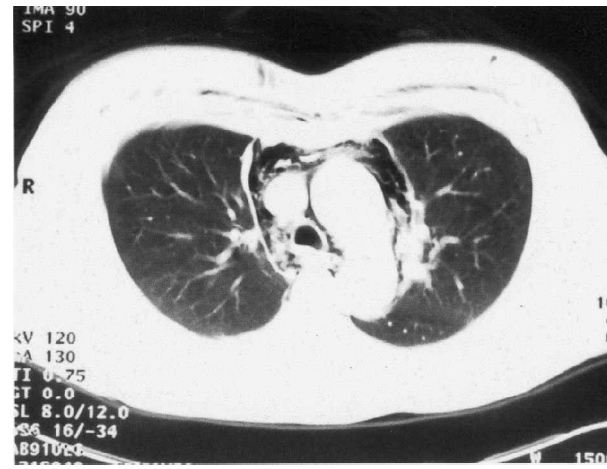

FIG. 3

An axial computed tomogram of the thorax showing the pneumomediastinum surrounding the aorta and superior vena cava.

pneumomediastinum and may help to identify the location of the injury. Mediastinal and neck abscesses may also be identified with computed tomography. A gastrograffin swallow may also be helpful; its specificity is reported as 75–100 per cent.[1]

If the patient is septic or showing signs of respiratory or airway compromise, a rigid laryngobronchoscopy and oesophagoscopy under general anaesthesia is warranted in an attempt to identify the injury site and proceed to repair. If the patient is clinically stable and improving with conservative treatment, this is not indicated. Rigid endoscopy was not performed in this case. The patient was clinically stable and there was no indication to subject her to further general anaesthesia with the risk of further aerodigestive tract injury. Even though the site of aerodigestive tract injury was not identified in this case, recovery was complete.

Historically, early surgical repair was the preferred treatment for most patients with upper aerodigestive tract injuries.[8] If septic, or developing airway compromise, surgical exploration is undoubtedly indicated. In the absence of clinical deterioration, management can be conservative.[7] The majority of such cases settle without surgical intervention, as illustrated in this case.

Conservative management is expectant. The patient should be closely monitored, kept nil orally and commenced on intravenous broad-spectrum antibiotics administered for a minimum of seven days. A naso-gastric tube should only be passed once an oesophageal perforation has been excluded, and if so, passage should be done under fluoroscopic guidance. Otherwise, parenteral feeding is indicated. The patient should be closely monitored for symptoms or signs of infection. Serial chest radiographs should be performed daily to assess resolution of the pneumomediastinum.

Conclusion

Subcutaneous emphysema and pneumomediastinum are rare following routine endotracheal intubation. Mechanisms of injury include direct trauma caused by endotracheal intubation or rupture of a congenital dehiscence. The severity of this problem should not be underestimated as there is a significant associated mortality. Early diagnosis with close monitoring, intravenous antibiotics and nil orally status is essential. The majority of these cases will resolve with conservative management.

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